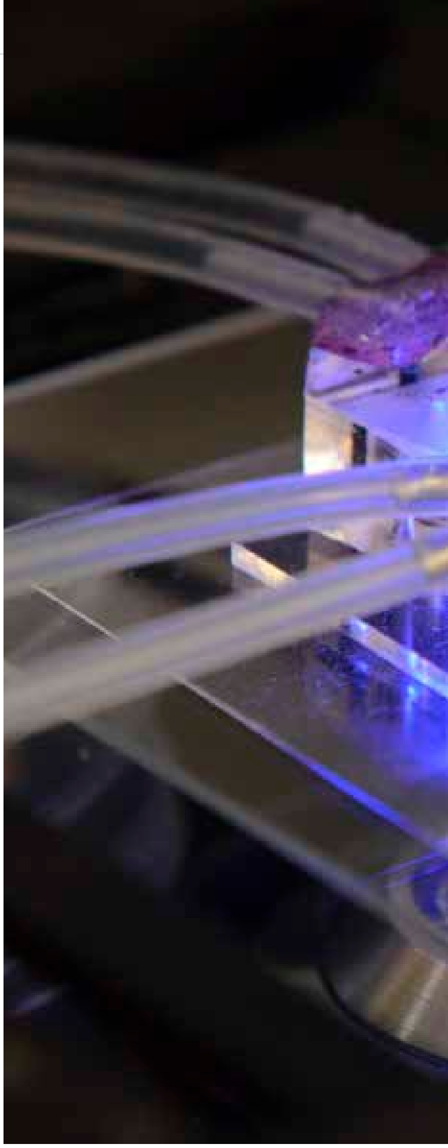
INNOVATOR

New Testing for TOXICS

US regulations push toxic testing from the backs of animals to the front burner of new technologies. **BY BRIAN COOLEY**



Our world looks little like it did in 1938 when the US began testing toxic substances on animals. Now we live in a digital and virtual age filled with photos that exist not on paper and trips to other worlds accomplished merely with goggles. Yet many animal tests have barely changed. Researchers still apply toxins to animals to document “endpoints,” the term they use for their observations: Did the animal’s eye turn red? At what dosage did 50 percent of the animals die?

Growing public discomfort with such methods, as well as a need for faster, cheaper and broader testing, helped spur the broadest overhaul of US toxic tests in 40 years when when President Barack Obama signed the Frank R. Lautenberg Chemical Safety for the 21st Century Act in June 2016. It updates the Toxic Substances Control Act of 1976 (TSCA), a foundational document of the Environmental Protection Agency.

The EPA will now use animals in toxic testing as a last resort, not first, while still demanding quality results and dramatically expanding the number of chemicals tested. It’s a big change, and tech is helping the industry get there.

“It’s a pretty historic piece of regulation,” says Erin Hill, president of the Institute for In Vitro Sciences, a testing research organization that counts among its contributors Procter & Gamble, British American Tobacco and PETA. “Maybe it doesn’t seem a big deal to the novice, but it’s the first time we see these requirements in any US testing regulation.”

Here’s a snapshot of the new toxic testing toolbox that can help satisfy both goals.

High-throughput screening

Your mental image of a toxic testing lab is probably one of people in white lab coats holding test tubes up to the light. Now put that image aside. Instead, many labs now operate as high-throughput where robots assemble millions of compounds and run thousands of tests per day. It’s a scale of research that would grind a human-run lab to a crawl. But it’s necessary to rule out dead ends quickly and economically so researchers can dive deep into more promising leads faster.

The EPA, Food and Drug Administration and National Institutes of Health (NIH) jointly launched a program called Toxicology in the 21st Century (Tox21) initiative in 2008 that targets 10,000 chemicals via high-throughput screening. That’s an impressive number, but with so much to do, the robots will be busy for a long time.

“The TSCA inventory [of chemicals to be tested] in the US is some 83,000 chemicals,” estimates Dr. Thomas Hartung, director of the Center for Alternatives to Animal Testing (CAAT) at Johns Hopkins University. “The largest database is 144,000. And there’s about 80 million substances which have been synthesized by chemists so far.”

In vitro in 3D

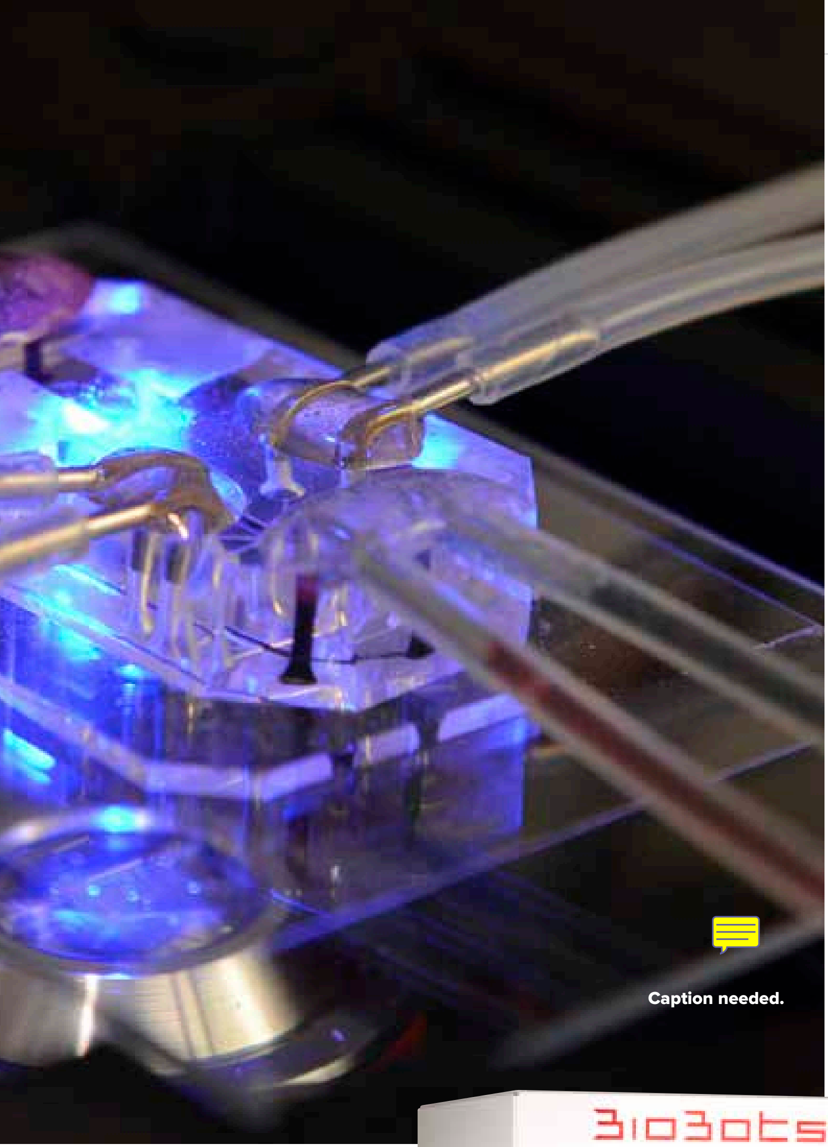
“In vitro” may bring to mind putting something in a petri dish during high school biology class and coming back the next day to see if it’s grown into something fuzzy and gross. That’s a simple example of monoculture in vitro testing, a test using a flat layer of cells in a petri dish. Today’s in vitro test is more complex, using human cells painstakingly deposited on tiny 3D scaffolds that encourage the cells to knit together and arrange their orientation like real skin or other tissue.

It’s an advancement that has shocked Dr. George DeGeorge, chief scientific officer at MB Research Labs in Pennsylvania. “If you asked me five years ago, ‘Can we use skin models to detect an allergic reaction?’, I would have said, ‘No way. It would take another 20 years,’” he says. “But in less than 10 years’ time, not only are there five such tests out there, but we invented one.”

Such methods also deliver a more mechanistic understanding than before. “You can see different pathways in cells being turned on and off,” says Hill. “When you use an animal for the acute endpoints, that’s not really telling you what’s going on inside; it’s very crude.”

Bioprinting

Researchers are starting to use 3D printing to create humane tissue samples that could allow them to skip some animal tests altogether. San Diego lab Organovo prints stacks of cells to build living tissues so realistic that when they print



Caption needed.

heart cells they actually beat. They don't look like a heart, but they physiologically react to drugs and toxics like one.

"We probably will never get to the point where we engineer complex organs to the mini detail," Gabor Forgacs, scientific founder of Organovo, told a TedMed audience in 2011. "The good news is that we do not need to re-create evolution. What we need to do is to engineer organs that are functionally equivalent."

"Bio printers are the next step: More control, more intricate geometries and more repeatability. It's what the world needs right now," says Danny Cabrera, CEO of Philadelphia-based bioprinter maker BioBots. They offer a selection of "bio ink" cartridges similar to the ones you put in your home printer. Researchers add the kinds of human cells they want to test and use standard CAD software to design the shape they want to print. It all results in a level of control and intricacy that is hard to equal with current handmade 3D structures or an non-human animal test, along wth a degree of "Appleness". "We're all about great tools for scientists that are a joy to use," says Cabrera, "so then when they use them, they aren't thinking how much their lives suck."

PHOTO CREDIT

THE BIG 4 U.S. ENVIRONMENTAL LAWS

1963	Clean Air Act
1972	Clean Water Act
1973	Endangered Species Act
1976	Toxic Substances Control Act

Organs on a chip

Few techniques are as hot and hyped today as the interface of tissue and silicon. The results hardly look like the invincible cyborg you might be imagining — rather think of a small piece of plexiglass with some wires and tubes coming from a chip in the middle. But the cells on it are structured like real tissues, even flex and move like them and, most importantly, can throw off digital outputs when exposed to toxins. It's a small slice of the readable human and a brand-new field.

"No one's ever seen this data before," Dr. Donald Ingber, founding director of the Wyss Institute at Harvard, told the Congressional Biomedical Research Caucus. "This isn't mimicking (existing) physiology; this is a prediction from this little chip."

The Wyss Institute's lung on a chip is the best-known example of the technology, but NIH, DARPA and the FDA are coordinating a dozen organizations that are working in parallel on heart, brain, liver and even an entire female reproductive tract on a chip. The end goal is toxicology's holy grail: a virtual human-on-a-chip where researchers can test toxicity on an organ system, not just on single organs in isolation.

Ingber imagines a few possibilities. "Maybe [it's] an aerosol-based drug inhaled by the lung, metabolized by the liver, peed out by the kidney to see if it induced heart toxicity," he says.

TOXIC TESTING: WHO OVERSEES WHAT?

→ EPA

Detergents & Cleaners
Pesticides
Drinking Water
Mercury
Airborne Particulates
Antimicrobial Sanitizers

→ FDA

Food
Drugs
Biologics (vaccines, blood)
Medical Devices
Radiating Electronics
Cosmetic Colors

The alternatives road map

By 2016, the EPA will be required to develop a strategic plan to reduce, refine or replace vertebrate animal testing. For DeGeorge, at least, the animal welfare movement has helped advance his business. As he estimates, in vitro is now 70 percent of what what MB does.

The other side of the coin for developing alternative animal testing is the FDA, which oversees toxicity of a different set of products than the EPA. (See sidebar.) Yet, the FDA may at least find inspiration for alternatives in its cosmetics jurisdiction: The European Union, UK, India, Israel, South Korea and, soon, Australia all require non-animal test technologies for cosmetics.

"You will not (yet) get a pharmaceutical approved in the US without animal testing," says DeGeorge, but "that may be kept to a minimum if they find (non-animal techniques) very safe and it can be moved right into human testing." ●

Brian Cooley (@briancooley) is CNET's editor at large.

Tech and the CITY

The tech industry is the source of great wealth in San Francisco. Could it also help the city's least fortunate?

BY SAMANTHA RHODES

Del Seymour lived on the streets in San Francisco's Tenderloin district for 18 years, hustling for his next fix. For San Franciscans, this gritty neighborhood is synonymous with homelessness, drugs and destitution.

It's also home to 17 tech companies — including Twitter, Dolby Laboratories, Spotify and Zendesk — attracted in part by tax breaks and other incentives from the city. This makes the Tenderloin and its neighboring Mid-Market area a weird study in contrasts, as thousands of young tech professionals step around the area's poor and homeless on their way to work.

"I see all of my brothers and sisters with nothing to do, who want to go to work," says Seymour, who got off the mean streets eight years ago after a "spiritual revival" changed his life. "And then I see the tech cathedrals on the other side of this street. There's something wrong with this picture."

The tech industry has brought great wealth to San Francisco. Tech companies fill its office space. Well-paid employees pay the country's highest rents and spend more than $100 for dinner without blinking an eye. Almost by itself, the local techniverse has widened the gap between the city's haves and have-nots. Only New York has more homeless per 100,000 residents than San Francisco, according to the latest statistics.

JAMES MARTIN

An unexpected spot of color in San Francisco's gritty Tenderloin district.

Silicon Valley is trying to lend a hand.

Apps like Copia (formerly Feeding Forward), Waste No Food and Food Cowboy match businesses that have surplus food — such as restaurants, grocery stores and wholesalers — with nearby soup kitchens and shelters. Others will match volunteers with nonprofits or get corporate sponsors to donate to your favorite charity.

Websites like HandUp and Indiegogo's Generosity will crowdsource donations to individual as well as humanitarian causes. And the nonprofit organization Project Homeless Connect gives out phones and bar codes to the people it serves, part of an innovative method for delivering critical services.

Seymour took a more direct approach: He got those "tech cathedrals" to provide the training and resources for Code Tenderloin, a combination coding boot camp and job-coaching service he founded last year.

The right stuff

Cornell Doss, 49, lost his job as a security guard last year, just before Christmas. Without a paycheck, he'd sometimes skip meals to make sure his 12-year-daughter had enough to eat.

In February, he signed up for Code Tenderloin's four-week interview course, meeting for three hours, twice a week. Think of it as intensive job coaching taught by people in the tech industry, such as GitHub, LinkedIn, NerdWallet and Dolby, often from their offices.

Doss learned everything from building an effective resume to how to carry himself in an interview (sit straight, make eye contact, don't cross arms) and questions he should ask. He also practiced in mock interviews and even shadowed the trainers during their day jobs.

> "If you can't be seen, technology at least allows you to be heard."
>
> KARA ZORDEL, PROJECT HOMELESS CONNECT

"They were real, real specific, even to the point of being early for the interview, doing your homework and research on the company, and how to market yourself," says Doss. "I knew some of the resume tricks, but [everything else] was all new to me."

Still, it's one thing to land a job — another to be qualified for it. In San Francisco, being qualified usually means knowing how to program. That's why Code Tenderloin also offers Code Ramp, a five-week, 60-hour course — again taught by experts from local tech companies —on website development.

"I took this class to become independent," says Hector Calderon, 54, who previously spent 11 months living on the street with his two boys. "[It's] another item to have when you apply for a job and, hopefully, make good money."

In the land of tech...

Project Homeless Connect quite literally brings together every service a homeless or low-income family could conceivably need. Five times a year, PHC holds all-in-one help days where more than 150 nonprofits and city agencies meet under one roof. It's a one-stop center for haircuts, medical and dental care, eyeglasses, wheelchair repair and employment counseling. There are also daily events for services like vision exams, dentures and clothing.

PHC gives each person it serves a bar code on a bracelet, then scans that code whenever someone, say, picks up a week's worth of food or comes in for dental care. The information helps PHC stay ahead of demand.

Everyone who walks through PHC's doors gets a 3G smartphone, provided by donors like Assurance Wireless, a lifeline assistance program from Virgin Mobile USA, or by Google, which provides Nexus phones. Carriers have donated minutes for those phones.

"Not only is technology important for people to learn about services, it's a big piece of how our society connects," says Kara Zordel, PHC's founder and executive director. "You're really isolated if you don't have technology."

One member used his PHC-supplied phone to call his mother for the first time in 20 years. It was her first confirmation he was still alive, says Zordel.

First, connect

No one knows for sure how many people are homeless in the United States. The best number we have is 564,000, based on a single night every year in late January when volunteers count people living in shelters and on the streets. The US Department of Housing and Urban Development estimates the real number could be 2 million.

There are so many homeless in San Francisco, people living there see them as just another part of the landscape, like the dozens of buildings that bear the names of tech giants. Tech is the engine driving San Francisco's wealth; now, it could help the city's least fortunate.

"If you can't be seen, technology at least allows you to be heard," says Zordel.

"You'll never be part of the conversation without it." ●

Samantha Rhodes (@samanthakrhodes) is a Washington, D.C.-based reporter who's covered tech, politics, culture and local news. She once kissed an alligator on the mouth. Needless to say, she grew up in south Florida.

JAMES MARTIN

YOU

WEARABLES • APPS • PERSONAL TECH

> “New ships coming on the market provide great new digital experiences.”

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Brain Games

Could brain-training apps one day help the millions of Americans living with Alzheimer's? BY IAN SHERR

I'll never forget the look of fear on my mother's face.

My mother was a brilliant woman. She earned three bachelor's degrees and a master's, and could have become a doctor if not for the rampant sexism she faced in college in the early '60s.

Instead, she worked for a major airline, where she applied her math smarts calculating a cargo load's weight and balance that would allow a plane to safely take off.

But after spending nearly a decade working the overnight shift, she was starting to get absent-minded. At first it was little things, like she'd go somewhere without the documents she needed. Then it was big things. Then she got in a car accident.

My mother was shocked when she came out of the doctor's office after weeks of testing. She was diagnosed with early-onset Alzheimer's disease. At 57 years old.

My mother was merely told to do anything that required thinking. She did crosswords. She read books. And since she was already good at math, she calculated the value of her invested retirement nest egg against the stock market's moves.

If she were alive today, she probably would type Alzheimer's into an app store. The first hit is an Alzheimer's patient-care app called MindMate, which includes interactive brain games it claims will "stimulate user's cognitive abilities based on world-leading research." There are dozens more.

Over the past few years, there's been an explosion of apps and websites promising to solve what medical science hasn't. Many claim they'll improve the brain, or even help fend off the disease. Experts say all are peddling false hope to people who have just been told they're going to lose their minds. There's no scientific proof any of these apps do what they claim. But since more than 5 million Americans are living with Alzheimer's, according to The Alzheimer's Association, there's big demand for a fix.

"People are willing to try anything when they're desperate," says Creighton Phelps, a deputy director at the National Institute on Aging.

There may be some hope. Data suggest activities like learning a new language or reading about something far outside your comfort zone could delay the symptoms from worsening. And researchers this year reported that a specific kind of computer game could even prevent dementia.

Mental exercise

Brain-training games typically ask players to perform tasks like remembering the shape on a card, re-creating a pattern or identifying the direction fish are swimming.

You might get good at the games, but there's no scientific proof they, or apps like them, actually do anything for you.

TIM MARRS

Remember the marketing blitz from Lumos Labs? The company claimed its puzzle app Lumosity could do just about anything, from helping with schoolwork to protecting against dementia —even improving "outcomes in combat veterans suffering from traumatic brain injuries."

That got the attention of Michelle Rusk, an attorney in the Federal Trade Commission's Bureau of Consumer Protection. She found science didn't support Lumos' marketing. The FTC filed a complaint against Lumos alleging it deceived consumers with "a host of false or misleading" claims.

"Lumosity preyed on consumers' fears about age-related cognitive decline, suggesting their games could stave off memory loss, dementia, and even Alzheimer's disease," the FTC said in a statement earlier this year. "But Lumosity simply did not have the science to back up its ads."

A judge agreed, and fined Lumos $50 million.

"Lumosity's case is interesting because we didn't say it was absolutely fraudulent and of no value," says Rusk. Instead, the order banned Lumos from making claims it can't back up.

The company now sells Lumosity as "delightful" entertainment.

"If you're going to spend time, why not spend time doing something that's fun and entertaining and emotionally makes you feel better?" says Lumos CEO Steve Berkowitz.

Game on

A speed-training game used in a 10-year study made headlines earlier this year when The Alzheimer's Association highlighted results showing it can cut the risk of dementia by half.

The study — called Active, for Advanced Cognitive Training in Vital Elderly — asked 2,832 healthy adults, ages 65 to 94, to simultaneously identify objects in the center and along the edges of a computer screen. It's called speed training because correct answers trigger the game to display more objects at an ever faster rate.

The game could look like this: You see cows in a pasture. Two cars are in the center of the pasture and road signs are scattered around the edges. Now identify one of the cars (the convertible, not the coupe) and the Route 66 sign, but without moving your head or eyes. As you progress, you'll see more distractions but have less time to spot them.

"It's fundamentally a new kind of medicine," says Henry Mahncke, CEO of Posit Science. The company acquired the brain-training game used in the Active study in 2008. Posit Science now offers an updated version, called Double Decision, as part of its BrainHQ online service.

"People are willing to try anything when they're desperate."

CREIGHTON PHELPS, NATIONAL INSTITUTE ON AGING

Mahncke emphatically believes such apps could rewire the brain, and thinks doctors will begin writing prescriptions for apps like Posit's within the next five years. He plans to seek approval from the Food and Drug Administration sometime soon. Doctors "want low-cost intervention," he says. After regulatory approval that's exactly what these apps will offer.

No one really knows why my mother got so sick so early in her life. Between poor record keeping and the general fuzziness that comes with time, it's hard to tell how far back Alzheimer's or dementia goes in my family. I do know my father's mother had it. My father hasn't developed symptoms and neither has my older brother.

In the meantime, I look at my infant son and wonder if there's anything I can do today, to avoid what happened to my mother.

There's no cure. I'm hopeful there will be. ●

Ian Sherr (@iansherr) manages CNET's cybersecurity, search, social and Silicon Valley news coverage — and is always on the hunt for tech that makes life and work easier.

The New Space Race

Silicon Valley's leading visionaries have set their sights on spaceflight. Their efforts just might put us on Mars. **BY LUKE LANCASTER**

The live-stream video lasts only a minute: A gray platform the size of a football field bobs somewhere in the Atlantic Ocean. A 14-story rocket comes into view from the upper right of the picture. Arriving back end first, flames blazing in a landing burn, the rocket's headed for the floating target. The rocket is the SpaceX Falcon 9, and it's about to make history.

Four landing legs spring from the base, and the Falcon 9 gently makes touchdown — and stays upright.

SpaceX had tried four times before to land its Falcon 9 rocket on a robotic barge. Those either missed the target or hit it too hard, falling over and exploding.

"It's like trying to land on a postage stamp," SpaceX CEO Elon Musk said later in a press conference. "It's like a carrier landing versus a land landing." The company had managed one of *those* landings (and only one) four months earlier, on a pad it had built in Cape Canaveral, Florida.

There have been other successful (and failed) landings since that first one at sea in April. Each marks a milestone in SpaceX's efforts to "revolutionize space technology." More important, each brings us closer to commercialization of the spaceflight industry, as businesses increasingly see opportunities beyond the stratosphere.

SpaceX may be the best-known company in the space market, but it's far from alone. Others include Blue Origin, founded by Amazon CEO Jeff Bezos, which has successfully launched and landed its own rockets. Richard Branson's Virgin Galactic bills itself as the "world's first commercial spaceline" for passengers willing to pay $250,000 a ticket. Vector Space Systems aims to launch small satellites. And a startup called Moon Express just got US government approval to fly to the moon. Their goals differ.

Vector would like customers to book its "vehicles" to launch commercial satellites on demand. Moon Express envisions a future in lunar mining, repairing satellites and clearing space junk, co-founder Naveen Jain told Time in August. Blue Origin wants to "seed an enduring human

presence in space," according to its website. That could range from moving heavy industry off-planet, as Bezos said in June, to colonizing other worlds.

And Musk wants to get to Mars.

It's not empty talk. Working with NASA, SpaceX expects to launch an unmanned Red Dragon space capsule to Mars as early as 2018. In June, Silicon Valley's best-known visionary said he intends to land a human-carrying spacecraft on Mars by 2025, followed every 26 months with fresh supplies and additional colonists.

"That's what it takes to sustain a civilization," Musk said.

That's assuming SpaceX doesn't have any major setbacks. It's already had two: In June 2015, a Falcon 9 carrying cargo to the International Space Station broke up midflight. And in September, explosions destroyed a Falcon 9 and its satellite payload during a routine test two days before its scheduled launch. The "incident — while it was not a NASA launch — is a reminder that spaceflight is an incredible challenge, but our partners learn from each success and setback," NASA said in a statement the day of the explosion.

Facebook had planned to use the destroyed satellite to beam internet service to rural Africa.

Rinse and repeat

Reaching these ambitious goals requires a series of advances.

For both SpaceX and Blue Origin, it comes down to making spaceflight cheaper by reusing rockets to launch people and cargo into orbit. It's going to take a lot of tries for that to become routine.

According to SpaceX's published price list, a Falcon 9 rocket costs about $62 million to launch. For comparison, United Launch Alliance says it costs about $225 million to launch one of its rockets. French competitor Airbus Safran Launchers claims its new Ariane 6 rocket will cost about $77 million.

$62 million

The cost of launching a Falcon 9 rocket.

While SpaceX already has the cheapest prices in space, the cost of launching a previously used Falcon 9 will be 30 percent less, according to company President Gwynne Shotwell. As of this writing, SpaceX expected its first relaunch sometime in the fall.

And Blue Origin? Refurbishing its New Shepard spacecraft costs "in the small tens of thousands of dollars," Bezos told Ars Technica this year. (Blue Origin's "reusable launch system" is much smaller than the Falcon 9 and is capable only of suborbital flight.)

"The focus on reusability is a service that no one else offers," says Casey Dreier, director of space policy for The Planetary Society, a nonprofit organization that promotes the exploration of space.

"NASA pioneered reusability with the space shuttle, but that came at a high cost."

The space agency has awarded SpaceX at least three contracts, worth more than $5 billion, to resupply the International Space Station. So far, private supply missions have ferried more than 59,000 pounds of cargo to the ISS, says NASA's communications officer, Tabatha Thompson.

"NASA's vision of commercial human spaceflight is of vibrant, profit-making enterprises enabling exploration," she says.

Where no one has gone before

It's hard to tell if SpaceX or Blue Origin is making any money from their efforts, since neither is saying. We do have a pretty good idea that SpaceX has agreed to spend about $300 million on just the 2018 Mars lander mission.

SpaceX "did talk to us about a 10-to-1 arrangement in terms of cost: theirs 10, ours one," NASA's Jim Reuter told a NASA Advisory Council meeting in July, after estimating the agency's cost at $32 million. "I think that's in the ballpark."

Why would Musk agree to such an uneven arrangement?

"Elon will be the first person they land on Mars," says Jim Cantrell, one of the founders of SpaceX and now CEO of Vector Space Systems. "It was pretty clear to me from the first day I dealt with him that's what he wanted to do."

Musk has a history of pushing established players in new directions. Many consider Tesla Motors the world's most influential automaker, pressuring nearly the entire industry to develop electric vehicles.

We're starting to see that same dynamic here as SpaceX and other "private companies push NASA to act and plan faster, to be more aggressive in their timelines," says Dreier.

The last time a human broke free from Earth's orbit was the Apollo 17 mission in 1972. We're about to reach out even farther, thanks in large part to the commercialization of spaceflight.

"We're going to Mars together," says Thompson. ●

Luke Lancaster (@LGLancaster) has a deep, abiding love for pop culture and games (both board and video). He has money riding on humanity setting foot on Mars in his lifetime.

MATT MURPHY

YOUR WORK

TECH ON THE JOB • 24/7 TOOLS

> “For a road warrior or long-termer, a taste of home, any home, can be just the antidote to long days of work in cramped quarters.”
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JOSH MILLER

CHECKING

JOSH MILLER

IN?

Here's why your next hotel for business travel could be an Airbnb.

BY JESSICA DOLCOURT

There was cold beer in the fridge, a city guidebook in the living room and plenty of towels. I dropped my bags, rummaged in the drawer for a bottle opener and took a deep, thirsty swig. Yep. As a crash pad and workplace, this Airbnb rental would do *jussst fiiine*.

I shouldn't be surprised. A tiny icon of a briefcase on Airbnb's website singled out this particular San Francisco apartment — the one I'm writing from now — as ideal for business travelers. A year old, Airbnb's business-ready listings program guarantees the presence of certain essentials that anyone traveling for work would need: shampoo, Wi-Fi, an iron and hair dryer, 24-hour access and a host with a good track record. (See sidebar for more.)

That icon is what made me give Airbnb another shot after some, um, *colorful* experiences for work and personal travel, like that weeklong rental equipped with just half a roll of toilet paper. And the one whose owner refused to give me more towels after the shower flooded the bathroom floor. Or how about the dingy "studio apartment" that reeked of perfumed kitty litter and despair? The promise of greater quality control is appealing when standards swing so wildly.

"That's the good and bad about an Airbnb," says Evan Konwiser, a vice president with American Express Global Business Travel, an Airbnb travel partner. "They're unique."

A taste of home

You'd think that employees traveling on the company dime would sneer at Airbnb's listings because each is so different from the next. Unlike traditional hotels, Airbnb

JOSH MILLER

Every Airbnb business travel home has to give you shampoo, Wi-Fi and 24-hour check-in.

doesn't let you collect loyalty points or seek help from an always-on concierge. There's no turndown service, no promise of a pool or fitness center, no cucumber water or 24-hour meal delivery. But there is character, and lots of personal space — in San Francisco, up to twice the size of a typical hotel room for the same price. There's a stove to cook your own dinner, a fridge to store the leftovers and a microwave to actually reheat them when hunger strikes.

For a road warrior or long-termer, a taste of home, any home, can be just the antidote to long days of work in cramped quarters. In inventory-crunched cities with sky-high hotel rates and only rickety, run-down options in your budget, a lower-priced Airbnb rental can improve your quality of life even if you do have to spring for your own TP. And reasonable hosts have been known to negotiate prices for extended stays.

"It's not like staying at a hotel downtown," says Marina Bianchi, an Airbnb "Superhost" who rents a well-lit studio apartment in San Francisco's residential Noe Valley district. "It's a real neighborhood," Bianchi adds. "Can you imagine being in the financial district for three weeks? Awful."

Still, the lack of daily housekeeping is a deal breaker for Cathy Park, a director at financial technology startup Xignite who hasn't used the program. "The last thing I want to do after a long day of work is to worry about cleaning the apartment." Otherwise, Park says she'd be willing to give up hotel perks to save money.

So far, the business program's proved effective. Employees from more than 50,000 companies have used it, according to Lex Bayer, Airbnb's head of global payments and business development — starting with Google and Salesforce.

Bayer knows that Airbnb lodgings won't please every traveler in every scenario, and that's OK. He also knows that Airbnb has work to do to keep its business-travel homes comfortable to stay in and easy to find online. Even then, things can go wrong.

"If you stay in a hotel and the internet doesn't work, there's support staff to ensure that you get it up and running," says Michael Olson, a senior research analyst at Piper Jaffray. "For an Airbnb, the host will likely do their best...but you may not have the same kind of guarantees."

As a frequent traveler, I value my loyalty points, comfy bed and helpful concierge. But as I contemplate my laptop planted on the glass kitchen table, the open bag of popcorn plucked from my welcome basket, the smoothly running Wi-Fi and greenery flashing outside the window, I admit to the alluring humanity of this domestic scene.

I also know I got lucky this time. Not every listing will be this homey, and I'll never stop packing my own shampoo. But if an evolving program of business-ready listings can keep prices in check and rental quality high, then staying in an Airbnb for work instead of a hotel is a gamble I'd be willing to take. ●

Jessica Dolcourt (@jdolcourt) has stayed in more hotel rooms than she cares to remember, including some she will unfortunately never forget.

WHAT YOU'LL GET FROM A BUSINESS-READY LISTING

- 24-hour check-in
- An entire home or apartment
- Smoke-free and pet-free environment
- Smoke and carbon monoxide detectors
- Wireless internet
- Laptop-friendly workspace
- Iron, hair dryer, hangers, shampoo, toilet paper, towels, clean linens
- Hosts have responded to 90 percent of booking requests within 24 hours (in the past year)
- 60 percent of reviews are five-star (including cleanliness)
- Minimum seven-day cancellation policy

BOOKER, BEWARE

Finding business-ready rentals isn't such a snap on Airbnb's website. I couldn't filter by listing type at the time of writing, which meant I wasted time hunting for eligible homes. Pinpointing the nightly rate also takes effort. Advertised quotes don't include the cleaning fee or local taxes, so a "$100" room could cost $250 or more.

Since Airbnb merely organizes renters, there's no quality control. Your shampoo could be a hotel castoff or come in an unmarked plastic squeeze bottle. The hosts themselves differ greatly, as well. Some organize binders full of useful information including local nightlife and the Wi-Fi password. Others are more hands-off.